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Schrott et al.

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[54] CIRCUIT ANTITHEFT AND DISABLING MECHANISM

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[22] Filed: **Jul. 29, 1996**

[51] Int. Cl.[6] **G08B 13/14**

[52] U.S. Cl. **340/572**; 340/551

[58] Field of Search 340/572, 551, 340/825.34, 825.54; 235/439, 488, 493, 230; 324/306, 309, 320, 224

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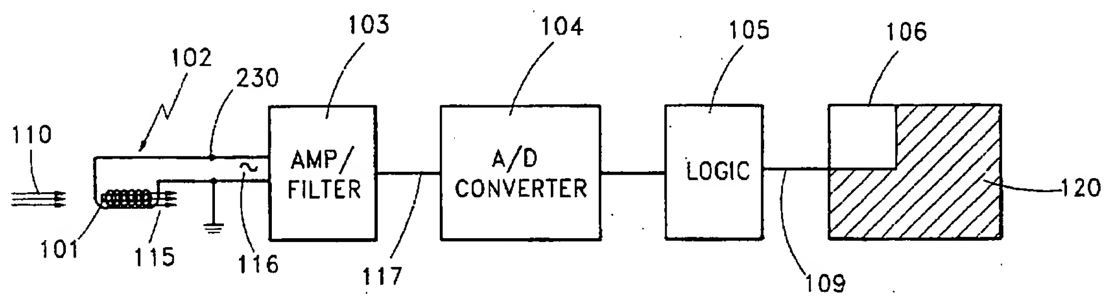
Primary Examiner—Brent A. Swarthout
Assistant Examiner—Van T. Trieu
Attorney, Agent, or Firm—Louis J. Percello

[57] **ABSTRACT**

The present invention is a magnetic sensor used with one or more frequency band pass filters and a logic circuit that produces a ("critical") signal that is used for enabling and disabling an external electronic circuit, e.g. a computer circuit. The magnetic sensor produces a signal when excited by an externally applied alternating current (ac) magnetic field. The external ac magnetic field can comprise one or more frequencies, each of which induces an electrical signal at the respective frequency in the sensor. Depending on the linearity of the sensor, one or more harmonic frequencies of the signal frequencies can also be induced in the sensor. One or more bandpass filters is connected to the magnetic sensor and each of the bandpass filters is tuned to filter the signal to select filtered signals, from the output of the sensor. A logic circuit is activated by one or more of the filtered signals or a combination of one or more of the signal frequencies. When the logic circuit is activated, a critical signal is applied to an electronic circuit to enable or disable the external electronic circuit.

12 Claims, 8 Drawing Sheets



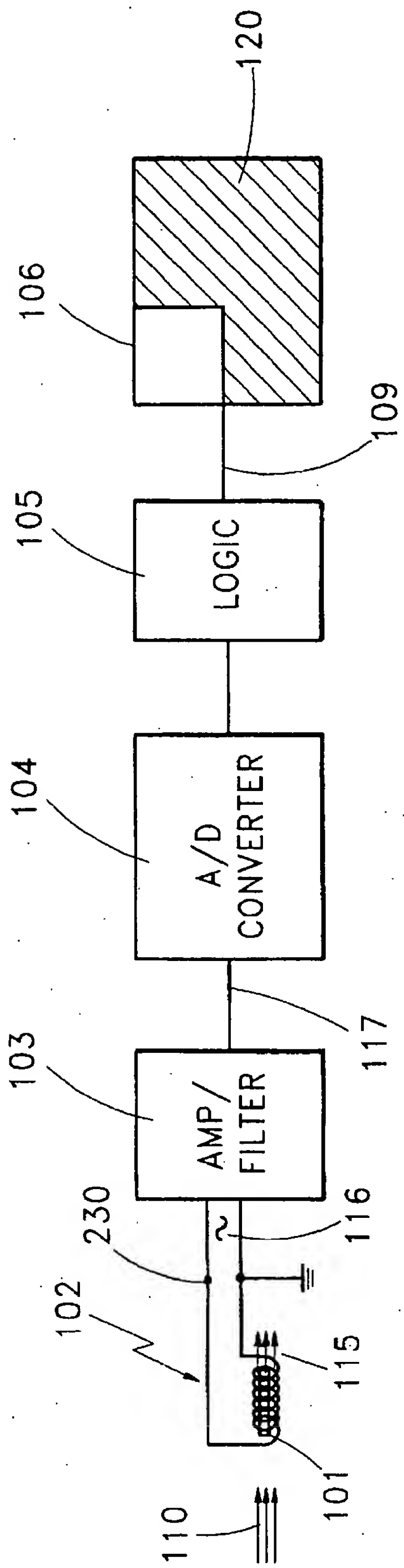

120
106
109
105
LOGIC
104
A/D
CONVERTER
103
AMP/
FILTER
117
230
116
102
115
101
110

FIG. 1

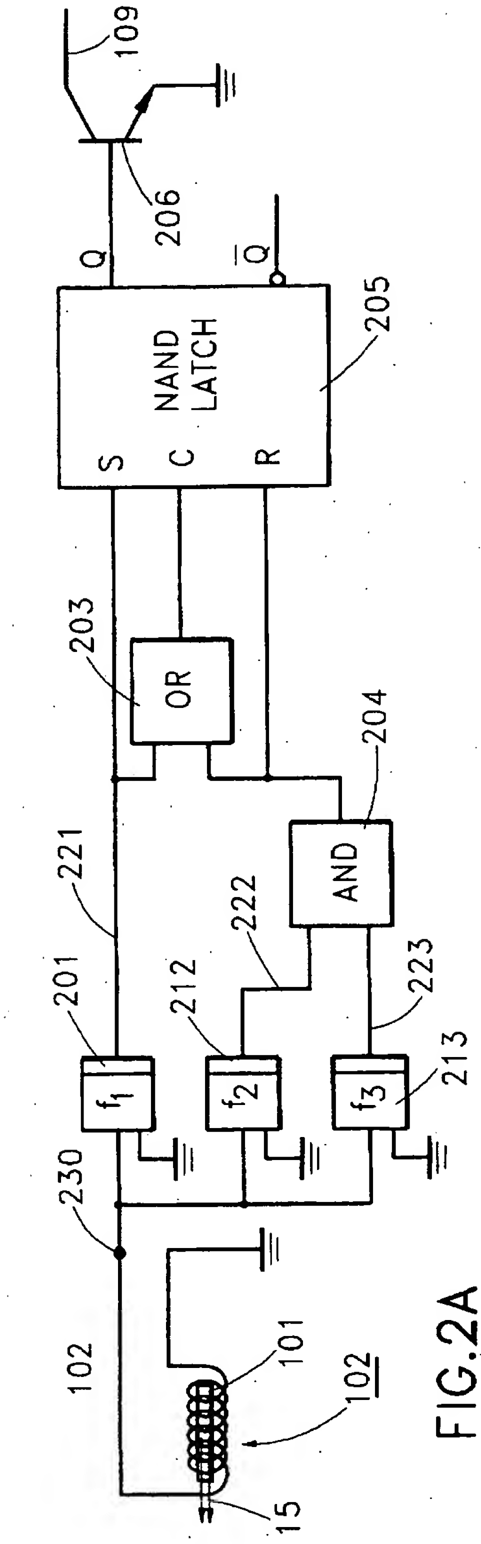


FIG.2A

REDUCED CHARACTERISTIC TABLE FOR THE GRATED S–R LATCHES

C	S	R	Q	OPERATION
0	0	0	Q_0	NO CHANGE
0	0	1	Q_0	NO CHANGE
0	1	0	Q_0	NO CHANGE
0	1	1	Q_0	NO CHANGE
1	0	0	Q_0	NO CHANGE
1	0	1	0	RESET
1	1	0	1	SET
1	1	1	0,1	RESET (S–R NOR), SET (S–R NAND)

FIG.2B
PRIOR ART

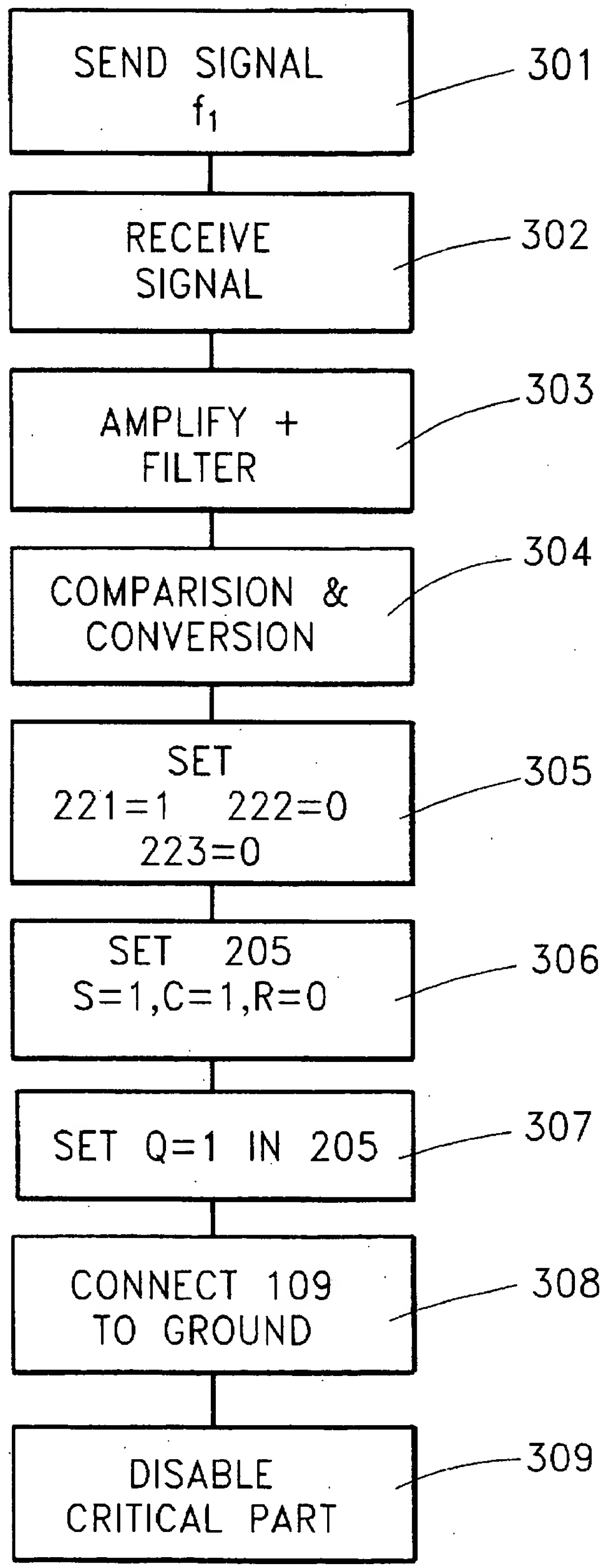

SEND SIGNAL f_1
301
RECEIVE SIGNAL
302
AMPLIFY + FILTER
303
COMPARISION & CONVERSION
304
SET 221=1 222=0 223=0
305
SET 205 S=1,C=1,R=0
306
SET Q=1 IN 205
307
CONNECT 109 TO GROUND
308
DISABLE CRITICAL PART
309

FIG.3A

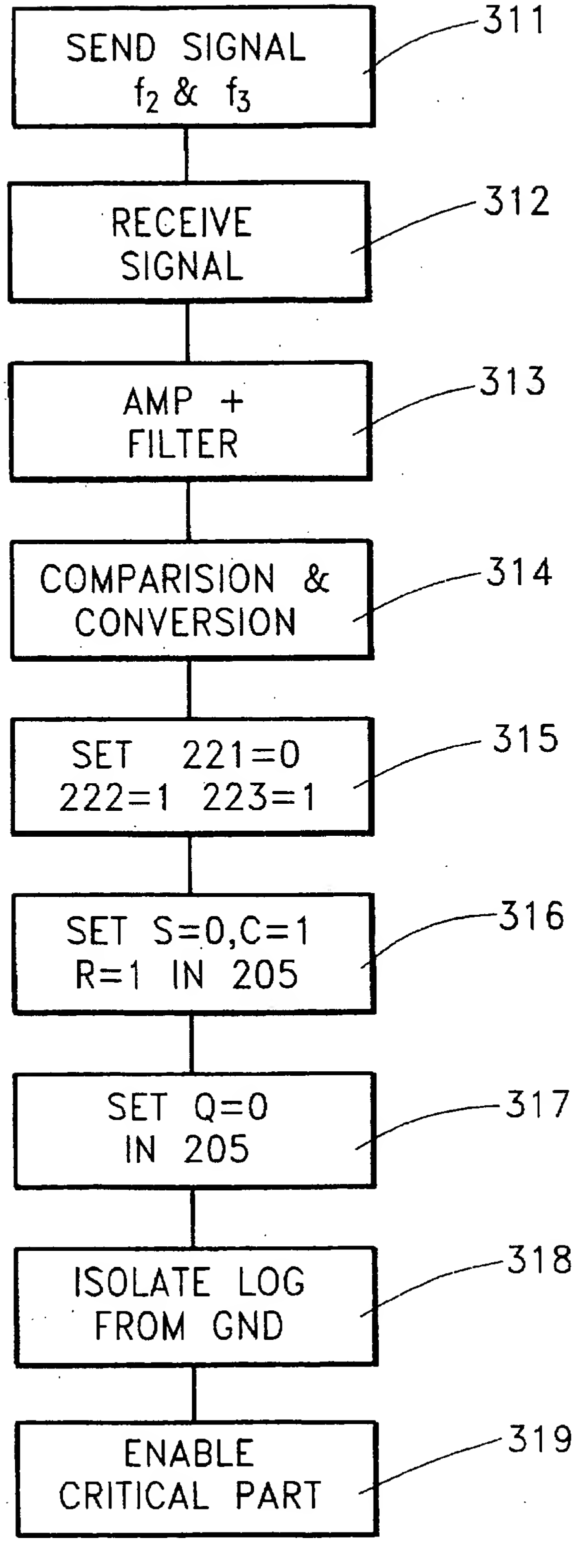
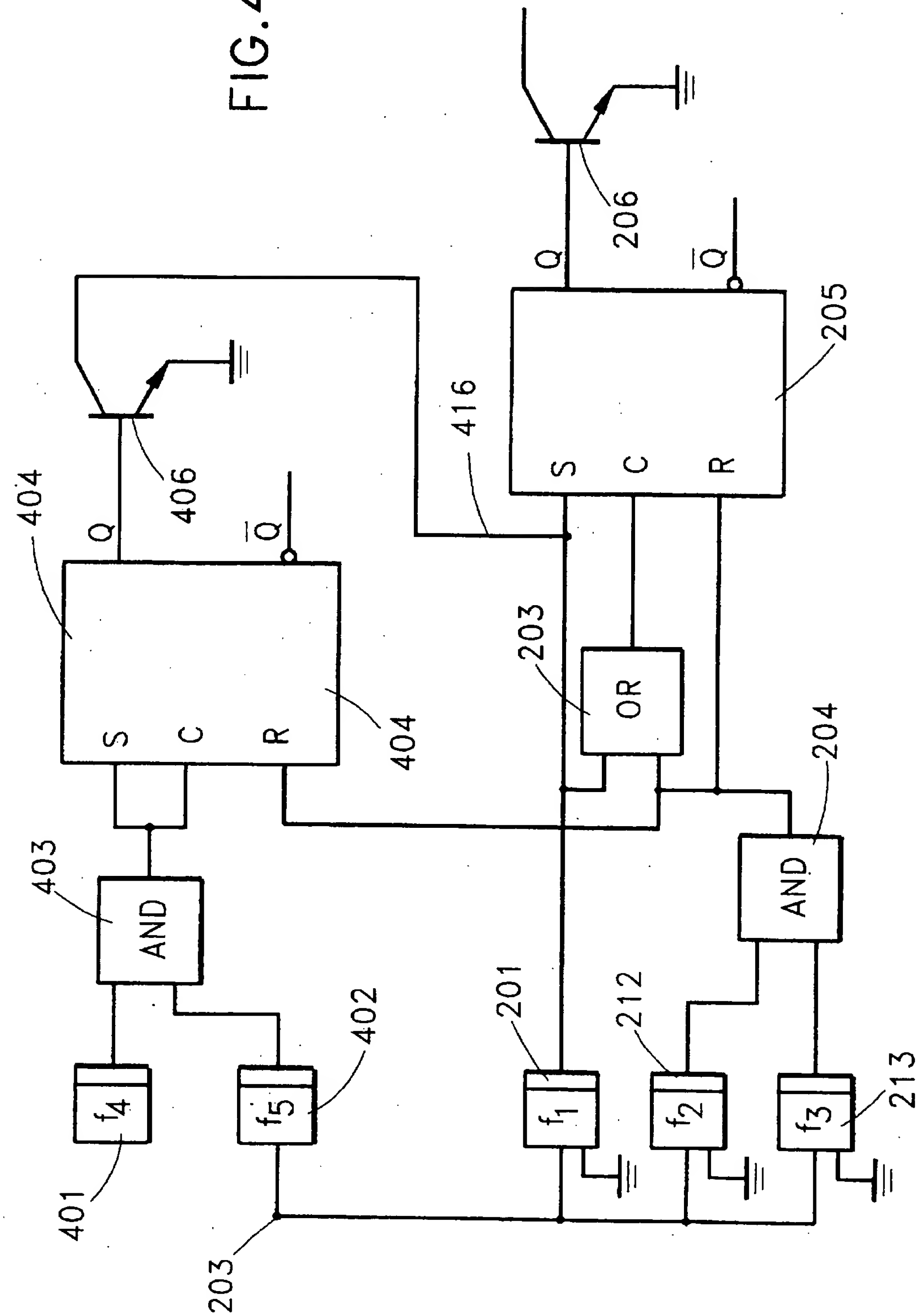

SEND SIGNAL f_2 & f_3
311
RECEIVE SIGNAL
312
AMP + FILTER
313
COMPARISION & CONVERSION
314
SET 221=0 222=1 223=1
315
SET S=0,C=1 R=1 IN 205
316
SET Q=0 IN 205
317
ISOLATE LOG FROM GND
318
ENABLE CRITICAL PART
319

FIG.3B

FIG. 4



Q
$\bar{Q}$
S
C
R
AND
OR
f_1
f_2
f_3
f_4
f_5
201
203
204
205
206
212
213
401
402
403
404
406
416

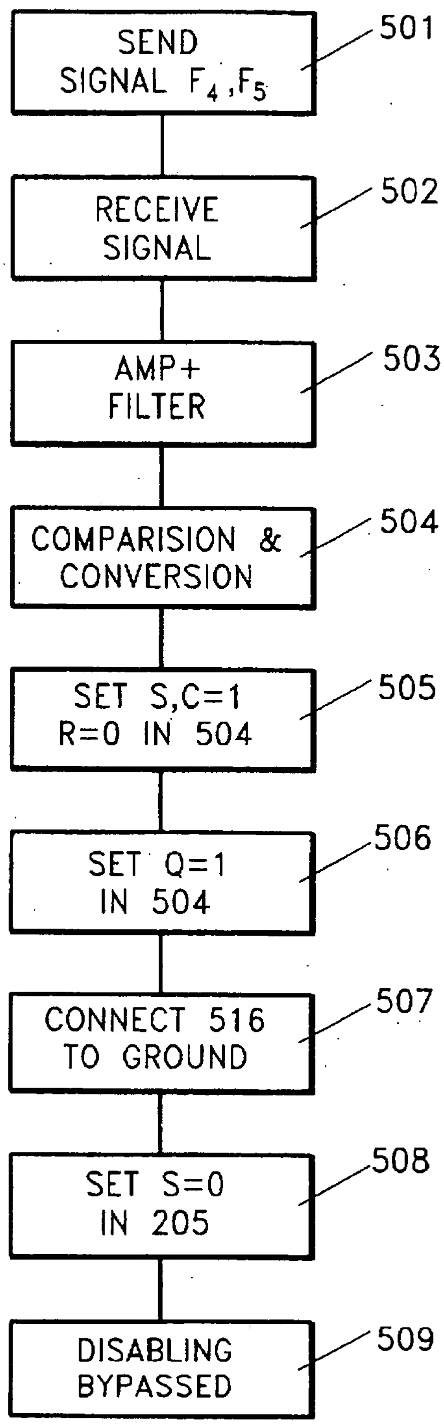

SEND SIGNAL F_4, F_5
501
RECEIVE SIGNAL
502
AMP+ FILTER
503
COMPARISION & CONVERSION
504
SET S,C=1 R=0 IN 504
505
SET Q=1 IN 504
506
CONNECT 516 TO GROUND
507
SET S=0 IN 205
508
DISABLING BYPASSED
509

FIG.5A

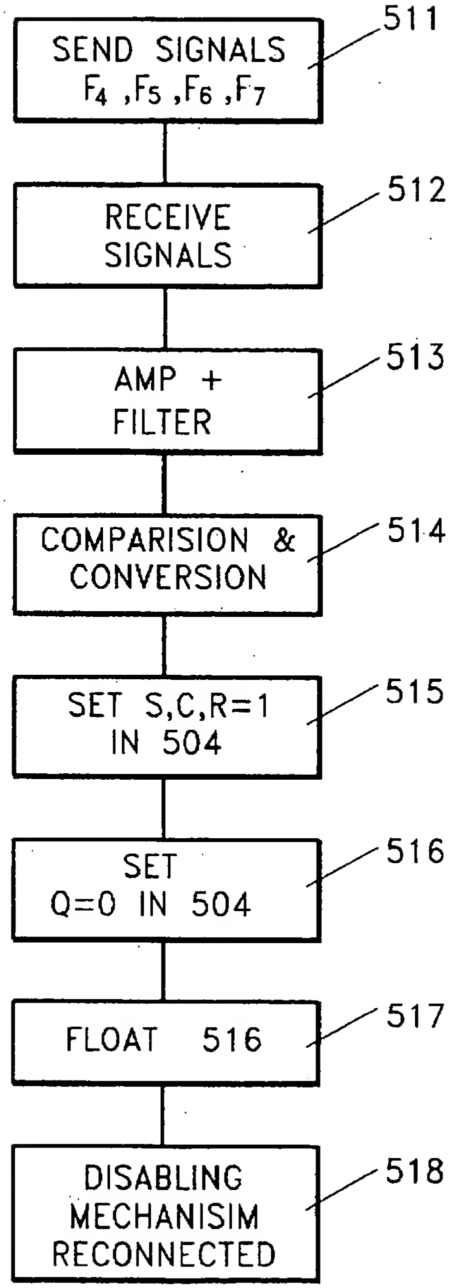

SEND SIGNALS F_4, F_5, F_6, F_7
511
RECEIVE SIGNALS
512
AMP + FILTER
513
COMPARISION & CONVERSION
514
SET S,C,R=1 IN 504
515
SET Q=0 IN 504
516
FLOAT 516
517
DISABLING MECHANISIM RECONNECTED
518

FIG.5B

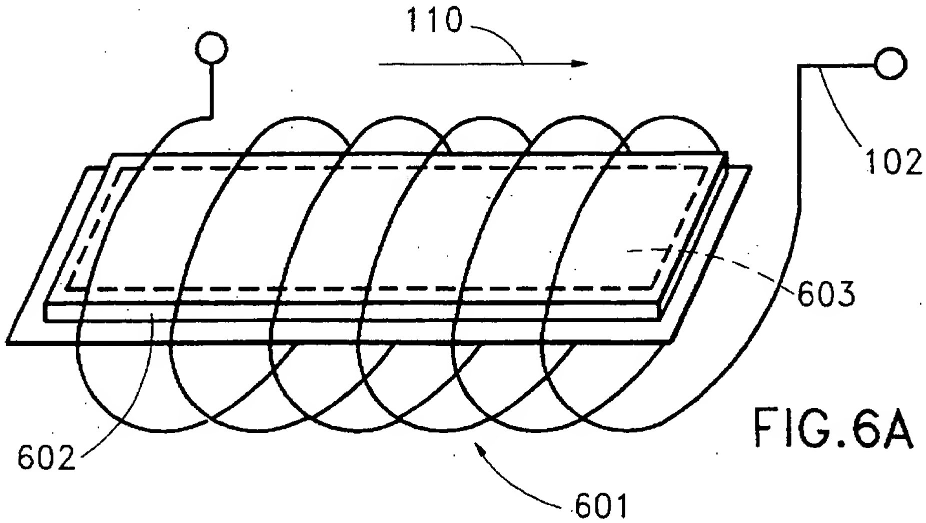


FIG.6A

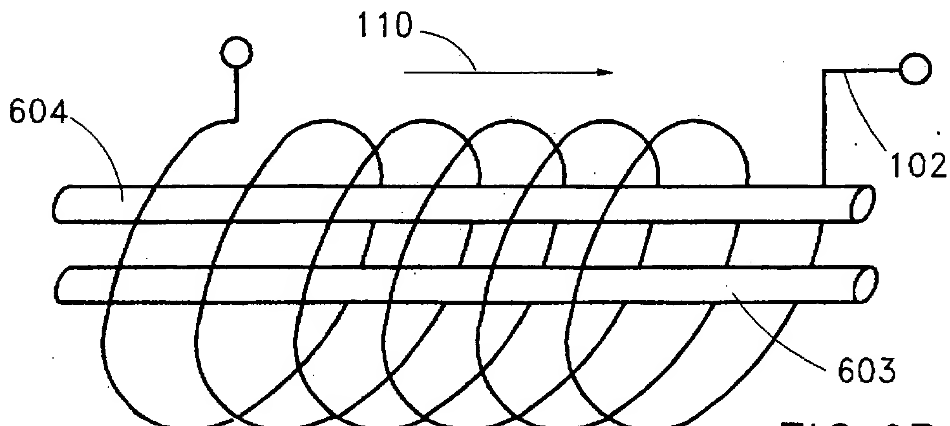


FIG.6B

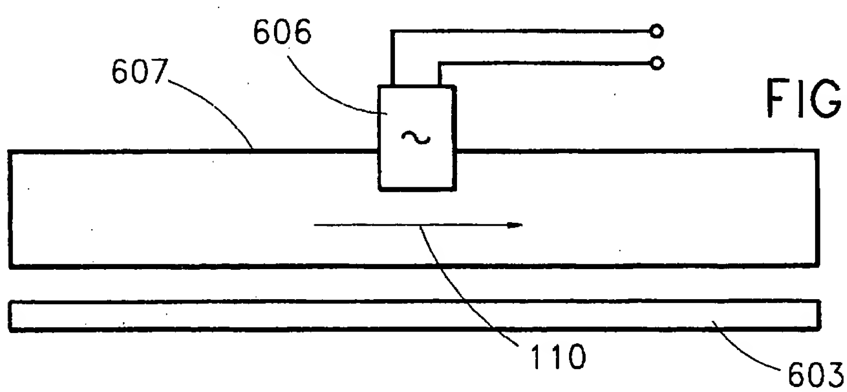


FIG.6C

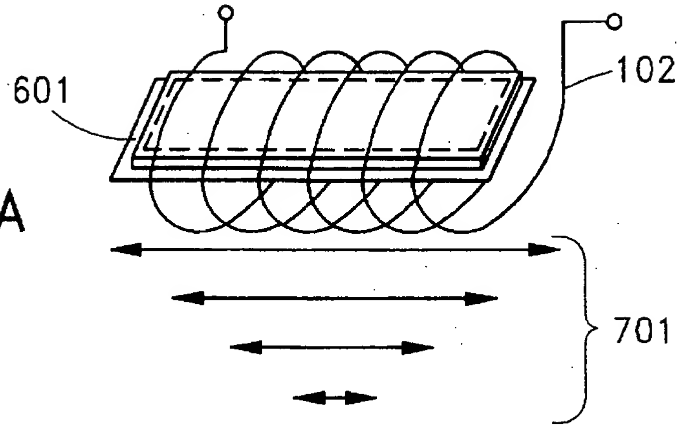


FIG.7A

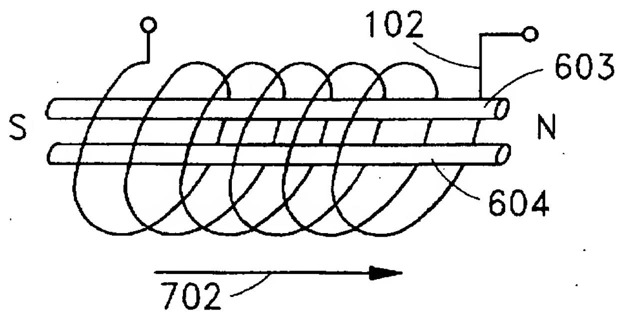


FIG.7B

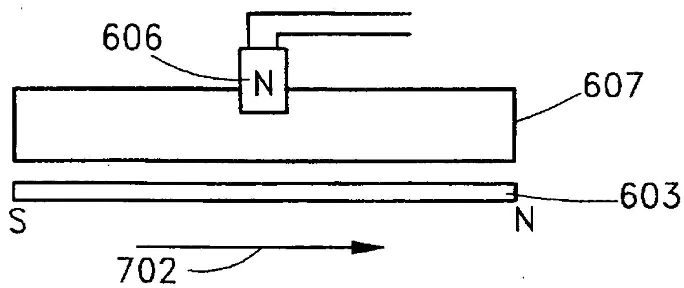


FIG.7C

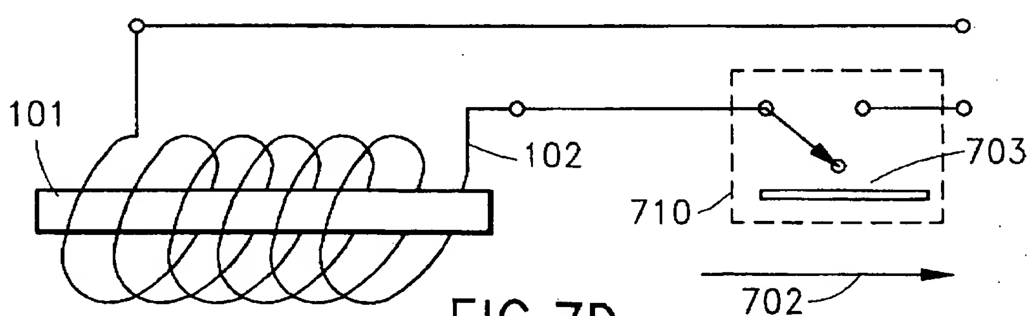


FIG.7D

CIRCUIT ANTITHEFT AND DISABLING MECHANISM

FIELD OF THE INVENTION

The invention relates to the field of radio frequency, magnetic, and acoustic tagging. More specifically, the invention relates to using a tag to disable/enable an electrical circuit, especially for theft prevention.

BACKGROUND OF THE INVENTION

Radio Frequency (RF) identification or tagging (RFID) systems typically use a base station radio transceiver to communicate with a tag (transponder) on an object. There are many uses for these RFID systems. See U.S. Pat. No. 4,656,463 by Anders et al. issued on Apr. 7, 1987 which is herein incorporated by reference in its entirety.

One use of RF tagging (RFID) systems is to prevent theft in the retail industry, e.g. the sale of electronic equipment. It is estimated that retailers and manufacturers lose at least one per cent of their sales every year due to theft or 'shrinkage'. The current approach to this problem is to place either an electronic article surveillance (EAS) tag, or an RF identification tag onto the item. Generally, these systems rely on either: 1. detecting the presence of a tag on an item within the proximity (RF field or field) of the base station or 2. communicating information to and/or from the tag, e.g. identity, object description, etc. Both of these systems rely on the ability of the reader to detect a tag as it leaves a designated area (base station field) and are only able to activate an alarm when a stolen item is detected. However, if a thief can pass the item through the base station field undetected, e.g. by shielding the tag from the base station RF signals, the prior art systems offer no deterrent to the theft.

The prior art has addressed the notion of remotely enabling and/or disabling a circuit with radio frequency transponders. Philips Corp. has disclosed a vehicle immobilization technology that only permits a vehicle motor to start when a changeable code is passed from a tag in an ignition key to a circuit that is connected to the vehicle engine. The tag is not electrically connected to the circuit. In this technology, a complex tag reader is needed for each engine circuit that is to be enabled/disabled. The relatively simple tag in the key has to be in a specific proximity (location) with respect to the tag reader in order for the reader to access the code on the tag. Further, the tag reader will require power from some source associated with the enabled/disabled circuit. Because of the complexity, expense, and power requirements of the tag reader, this system is limited to enable/disable expensive circuits with on board power.

STATEMENT OF PROBLEMS WITH PRIOR ART

There is a need for an effective and inexpensive device that prevents or inhibits theft of electronic circuitry, especially computer circuits. There is also a need for this device to perform its function in an environment that shields radio frequency signals.

OBJECT OF THE INVENTION

An object of this invention is a system and method for preventing or inhibiting theft of electronic circuits, particularly computer circuits.

Another object of this invention is a system and method that uses a standard and inexpensive tag that enables/disables an electronic circuit in order to prevent or inhibit the theft of the electronic circuit.

Another object of this invention is a system and method for preventing or inhibiting theft of electronic circuits when the electronic circuits are in an environment that is shielded from radio frequency signals.

SUMMARY OF THE INVENTION

The present invention is a magnetic sensor used with one or more frequency bandpass filters and a logic circuit that produces a ("critical") signal that is used for enabling and disabling an external electronic circuit, e.g. a computer circuit. The magnetic sensor produces a signal when excited by an externally applied alternating current (ac) magnetic field. The external ac magnetic field can comprise one or more frequencies, each of which induces an electrical signal at the respective frequency in the sensor. Depending on the linearity of the sensor, one or more harmonic frequencies of the signal frequencies can also be induced in the sensor. One or more bandpass filters are connected to the magnetic sensor and each of the bandpass filters is tuned to filter the signal to select signals, called filtered signals, from the output of the sensor. A logic circuit is activated by one or more of the filtered signals or a combination of one or more of the signal frequencies. When the logic circuit is activated, a critical signal is applied to an electronic circuit to enable or disable the external electronic circuit. Variations of the logic circuit permit the external electronic circuit be enabled if disabled and cause the disabling function to be bypassed.

To produce a critical signal, the magnetic sensors used need only communicate with a sensor mounted in close proximity within the same package in which the coil is mounted.

Various alternative embodiments of magnetic sensors are disclosed, including one that uses a commercially available magnetic tagging device. The magnetic tagging device is capable of communicating with a remote base station (gate) while also providing a signal to the coil.

DESCRIPTIONS OF THE DRAWINGS

FIG. 1 is a block diagram of a magnetic sensor and the accompanying local detection circuit for disabling an external electronic (e.g., computer) circuit.

FIGS. 2A and 2B depict a circuit diagram (FIG. 2A) that shows a preferred logic circuit (and circuit logic states—FIG. 2B) for disabling and enabling the external circuit computer.

FIG. 3A is a flow chart of a sequence of events leading to disabling the external circuit.

FIG. 3B is a flow chart of process steps leading to the reactivation or reenablement of the external circuit after prior disablement.

FIG. 4 is a circuit diagram for deactivating the magnetic sensor to prevent disablement of the computer by utilizing an external ac magnetic field.

FIG. 5A shows a flow chart leading to the by-passing of the disabling mechanism.

FIG. 5B shows a flow chart leading to reactivating the disabling mechanism.

FIGS. 6A–C are block diagrams of different commercially available tags using the invention to act as the magnetic sensor and to produce a magnetic field that is locally detected to activate/deactivate the external circuit and simultaneously to sound a remote alarm.

FIGS. 7A–C shows means for deactivating the tags shown in FIGS. 6A–C by using a magnetic dc bias field.

FIG. 7D shows means for deactivating the tags by means of a magnetic switch.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIG. 1, the invention uses a magnetic sensor, in one preferred embodiment, comprising a pickup coil **102** and a soft magnetic material **101** which is the core of the pickup coil **102**. Because of the core's large permeability, typically at least several hundred times and more typically several thousand times as large as that of air, the externally applied ac magnetic field **110** will result in a large magnetic flux **115A** (due to the magnetic field **115**), rich in harmonics of the applied fundamental frequency, through the pickup coil **102**, emanating from the core **101**. The sensing of this flux results in a voltage **116** produced in the pickup coil **102** which can be amplified and filtered in an amplifier/filter circuit **103** to select a distinct predetermined frequency. The filtered signal **117** can be converted to a logic signal in the a/d converter unit **104** used to activate a logic circuit **105** which generates a critical signal **109** acting on a critical circuit element **106** of the computer or the electronic device (external circuit) **120** causing it to be disabled.

Magnetic field **115** is a result of the ac field **110** which causes a magnetization to be induced in the core **101** which is non-linear in its response to the field **110**, hence producing harmonics of the frequency of field **110**. Thus field **115** need only communicate with a sensor mounted in close proximity within the same package in which **102** is mounted. Thus, shielding problems are much less severe than those typically occurring for embedded 1 bit magnetic sensors. In that case, the fields produced by the sensor must be communicated back to a base station in order to be effective in theft detection.

For a description of critical part **106**, external circuit **120**, and the connections to the critical part **106** that enable/disable the external circuit **120**, refer to U.S. patent application No. (docket number YO996-037 assigned to IBM) entitled "Radio Frequency Identification Transponder with Electronic Circuit Enabling/Disabling Capability to Capek et al. which is filed on the same day as this application and is herein incorporated by reference in its entirety.

FIG. **2A** shows an alternative embodiment, where there is more than one amplifier/filter **103** and comparator/rectifier **104** components, assembled into modules hereafter called signal sensors, typically **201**, **212**, and **213**. Each of these signal sensors is capable of detecting a signal at a given frequency and producing a logic output used by the logic devices **203**,**204**, and **205**, respectively. These signal sensors contain band pass filters, amplifiers, and comparators and can be assembled from standard components that are well known. Therefore the respective logic devices (**203**, **204**, and **205**) receive a signal if the signal sensors (**201**,**212**, **213**) pass their tuned frequency, i.e., the fundamental frequency or any of the harmonics of the fundamental frequency produced by the coil **101**.

Note that in this embodiment, the filters are tuned to frequencies that are not integrally related. One or more signal sensors **201**. are tuned to a first frequency or one of the harmonics of this first frequency. However, a second set of one or more second signal sensors (e.g., either **204** or **205**) are not tuned to the first frequency or any one of the harmonics of this first frequency. Instead, each of the signal sensors in the second set is tuned to a frequency of the second set or one of the harmonics of each frequency of the second set. In a similar manner, there can be other signal sensors tuned to a third frequency or any harmonic of the third frequency, etc.

A typical disabling/enabling logic circuit is shown in FIG. 2A and a flow chart of the disabling steps is shown in FIG. 3A. A non limiting example is shown in FIG. 2A using a well known NAND gate with characteristics shown in FIG. 2B. Refer also to FIG. 3B.

When the applied magnetic field **110** containing only the fundamental frequency f_1 is sent **301**, the magnetic field induces magnetization that results in a relatively large, harmonically rich flux **115A** sensed **302** by coil element **102**. The harmonics are created by the non linear permeability of the core **101** as described by the hysteresis curve of the core. Therefore, a current is induced in the coil **102** that is also rich in harmonics containing not only the fundamental frequency, f_1 but also the set of frequencies f_{1i}. harmonically related to f_1. The signal **116** is amplified, filtered, compared, and converted to a logic signal **221**.

The logic signal **221** consisting of either a '1' or '0' is applied **305** to point 'S' of the 'S-R NAND' latch **205** and to the input of the 'OR' gate **203**. If signal **221** corresponds to a '1' logic bit, indicating the presence of a signal with a given frequency e.g., the fundamental f_1, this input sets **306** the points 'S', 'C'. 'R' in **205** to '1', '1', and '0' respectively. In this case the signals **222** and **223** are null because the ac magnetic field **110** does not cause the core **102** to produce the frequencies f_2 and f_3, which belong to the second set of frequencies, and are not harmonically related (integral multiples) of f_1. Since the signal **110** does not contain the frequencies, f_2 and f_3, 'R' is set to '0' because the inputs **222** and **223** to the AND gate **204** are zero.

Therefore the output 'Q' in **205** will be set **307** with a value '1' applied to the base of the transistor **206** or to any device with a similar function. The last step **307** produces a conducting path between collector and emitter in the transistor **206** connecting **308** line **119** to ground. The grounding of line **119** disables **309**, the critical part **106** of the computer or electronic device **120**.

Note that FIG. **2B** shows the characteristic table of a typical prior art NAND latch **205**. For a discussion of NAND latches **205** and other logic circuits see *Modern Digital Designs* by R. S. Sandige, published by McGraw Hill, 1990, which is herein incorporated by reference in its entirety.

To re-enable the disabled computer or electronic device **120**, the signal **110** must provide a set of one or more (preferably two or more) second frequencies, applied simultaneously, that are not harmonically related (integral multiples) of the first frequency, f_1. The set of second frequencies, for example f_2 and f_3, are also not harmonically related, i.e., are not harmonics of one another. For example see step **311** in the flow chart, FIG. 3B. In one preferred embodiment, these second frequencies can be applied by a hand held source. In this embodiment, the signal **116** will have not only the fundamental second frequency(ies) but also the respective harmonic frequency components f_{2i} and f_{3i} which will be received **312**, amplified and filtered **313** and compared to a reference and converted to the logic signals (step **314**) by the signal sensors **212** and **213**. (In a preferred embodiment the signal sensors **212** and **213** are tuned to the fundamental frequencies f_2 and f_3 respectively). These steps set **315** logical '1's in **222** and **223** which are the inputs to the AND logic gate **204**. The AND gate **204** then sets **316**, the input at 'S', 'C'. 'R' to value of '0', '1', '1'

respectively. According to FIG. 2B, this sets **317** the output 'Q' of **205** to a logical '0' and thus establishes **318**, a high resistance path between emitter and collector of **206** leaving line **119** floating and reenabling **319**, the critical part **106** of the computer. Additional frequencies can be added to the signal **110** to make it more difficult to tamper or to break the re-enabling code. Each additional frequency will require an additional AND gate **204** to create the final logic input at point 'R' in device **205**.

Additional circuitry can be added to the logic **105** to make it possible to bypass the disabling mechanism so that the computer or electronic device can be moved past the disabling gate without disabling the device. This may be practical in an office where a computer can be authorized for overnight removal by a manager or an appropriate office personnel. In that case a circuit, like that shown in FIG. **4**, is used. The flow chart for the bypassing steps is shown in FIG. 5A. To bypass the disabling circuit, the signal **110** now contains only two or more deactivating (also called bypassing frequencies)) frequencies, e.g., f_4 and f_5 **501**, that are not harmonically related to either the first frequency or the second set of frequencies. Again, the received signal **502** will be amplified and filtered **503**, compared to a reference, and converted to the logic signal (step **504**) to set **505** the inputs of the AND logic gate **403** to be logical '1's. As a consequence, the output of **403** is used to set **505** the points 'S' and 'C' in the S-R NOR latch **404** to a logical '1'.

Since the signal **110** contains neither f_2 nor f_3, the output of **204** is a logical '0' and the signal at the point 'R' in **404** is a logical '0'. This sets **506**, the output 'Q' in **404** equal to '1', see FIG. 2B, connecting **507** the collector and emitter in transistor **406**, grounding the point **416**, resulting **508** in a '0' at point 'S' of the device **205**, regardless of the presence of f_1, leading, according to FIG. 2B, to a '0' in the output point 'Q' of **205** and therefore leaving line **119** floating irrespective of the presence of f_1, that is ungrounded, bypassing **509** the disabler circuit **105**.

The flow chart FIG. 5B shows the steps leading to a reactivation of the disabling circuit **105** once the bypass set of steps has been invoked as shown in the flow chart FIG. 5A. Here, the signal **110** contains the second frequencies f_2, f_3 and all the deactivating frequencies, e.g. f_4 and f_5 **511**. The received signal **512** is amplified and filtered **513**, compared to a reference, and converted to a logic signal (step **514**) so that the points 'S' 'C' and 'R' in **404** will be set **515** to '1's. According to FIG. 4B, this set of logical '1's sets **516** 'Q' equal to '0' in the 'S-R' NOR latch **404**. Therefore, a high resistance path is established between the collector and emitter of the transistor **416** allowing point 'S' in **205** to float **517** thereby reactivating **518** the disabling circuit **105**.

Other means to re-enable a disabled computer or to bypass the disabling circuit **105** could be accomplished through keyboard commands according to a secret code known only to appropriately designated personnel. By keying in commands in the secret code logic inputs bypass the signal sensors **212** and **213** and place logic signals directly on lines **222** and **223**. Alternatively, a set of electrical signals can be directly applied to the inputs of the signal sensors (**212** and **213**) with a frequency to which the respective signal sensors are tuned.

It can be very desirable to trigger the disabling mechanism **105** by using commercially available anti theft tags as the source of the magnetic field **115**. Moreover, it also desirable that the signal **115**, the field produced by the element **101**, has the capability of triggering the alarm of the gate. A simple method for achieving these two goals is to use a commercially available magnetic tag for the element **101**. In this way the entire tag will operate as an antitheft device, where the soft magnetic element receives and sends back a signal to a remote external gate, while the same signal is sensed locally by the sensing coil **102**.

FIG. 6A shows an embodiment where the element **101** has been replaced by an acousto-magnetic tag **601** (as described in the U.S. Pat. Nos. 4,510,489 and 4,510,490, assigned to Allied Corp. or more specifically in EP 0 592 780 A2, assigned to Sensormatic) where the soft magnetic material **602** is loosely encapsulated and therefore free to vibrate as a result of magneto elastic coupling. The soft magnetic material **602** is in close proximity to a strip of hard magnetic material serving as a magnetic bias **603**.

FIG. 6B shows an embodiment where the element **101** consists of a piece of soft magnetic material in the shape of a wire or a thin strip **604** accompanied by an adjacent piece of a magnetic material **603** of high coercivity. This embodiment is similar to tags that make use of the harmonic content of strips or wire of soft magnetic material undergoing a hysteresis loop as a result of external ac field excitation **110** (as described by U.S. Pat. No. 4,581,524 assigned to Minnesota Mining and Manufacturing Co. or to U.S. Pat. No. 4,660,025, assigned to Sensormatic).

FIG. 6C describes an embodiment where the functions of the coil **102** and the element **101** are produced by a magnetic wire capable of exhibiting the Matteucci effect, (see "Mechanism of Matteucci Effect Using Amorphous Magnetic Wires" by K. Kawashima, T. Kohzawa, M. Takagi, K. Mohri, M. Kanoch, and L. V. Panina, IEEE Translation Journal on Magnetics in Japan, Vol 8, No 5, May 1993, P. 318) The Matteucci effect produces a voltage pulse **606** that can be sensed along the wire **607** and results from the wire being in the presence of an ac magnetic field **110**.

The U.S. Pat. Nos. 4,510,489, 4,510,490, 4,581,524, and 4,660,025; the European Patent EP 0 592 780 A2; the IEEE Translation Journal on Magnetics; and the US Patent Applications entitled Concealed Magnetic ID Code and Antitheft Tag, docket number YO996-084 to Schrott et al. and A System for Concealed Serialization Utilizing a Soft Magnetic Antitheft Element, docket number YO996-085 to Schrott et al. are all herein incorporated by reference in their entirety.

The embodiment shown in FIG. 6C also shows a hard magnetic element **603** that can be used to disable the tag. The method for disabling these tags depends on their particular construction. For example, to disable the tag of FIG. 6A requires the use of a decrementing ac magnetic field **701** to demagnetize the element **603** as shown in FIG. 7A. The wire or strip **604** shown in FIG. 6B becomes inactive when the soft magnetic element **604** is saturated. This is accomplished by setting the hard magnetic element **603** into saturation by applying an external dc field of sufficient magnitude **702** and then withdrawing the external field **702**, leaving the hard magnet in its remanent state, as shown in FIG. 7B. Similarly, the field **702** can be used to leave the hard element **603** in its remanent state to disable the wire **607** by preventing it from producing a voltage pulse, as shown in FIG. 7C.

An additional method of rendering the disabling mechanism into an inactive state is by interrupting the conducting path between the sensing coil **102** and the filter array **103**. This can be accomplished by the use of a magnetic switch **710** as shown in FIG. 7D. Here a magnetic switch opens and leaves open a conducting path upon application of a dc magnetic field to provide the interruption in the conducting

path of the sensing coil **102**. Demagnetizing the magnetic switch **710** using a decrementing ac magnetic field **701** closes the circuit thereby reactivating the sensing coil **102**.

In some embodiments, a metallic enclosure, e.g., aluminum foil, does not shield the ac magnetic field because the frequencies of the field are typically lower than 100 kilohertz. At these frequencies the magnetic field has a larger skin depth than the skin depth produced by radio frequency signals typically used. (Note that the skin depth is inversely proportional to the square root of the frequency. The lower the skin depth, the greater the shielding.) Other frequencies of the magnetic field are possible, if they are required by using a commercially available tag as element **101**.

Given this disclosure, other equivalent embodiments of this invention contemplated by the inventors would become apparent to one skilled in the art.

We claim:

1. A system for enabling and disabling an electronic circuit comprising:

a. a magnetic sensor that produces a signal when excited by one or more externally applied alternating current (ac) magnetic fields, each magnetic field having a respective frequency, and the signal being an electrical signal that includes the frequency and zero or more harmonics of the frequency;

b. one or more signal sensors, electrically connected to the magnetic sensor, each of the signal sensors filtering the signal to select a respective filtered signal, comparing the filtered signal to a reference, and converting the compared signal to a logic signal; and

c. a logic circuit activated by one or more of the logic signals and sending a critical signal to the electronic circuit when the logic circuit is activated, the logic circuit having a disabling function that disables the electronic circuit when the magnetic sensor is excited by a first externally applied ac magnetic field with a first set of at least one first frequency that activates the logic circuit and where the disabling function is bypassed when the magnetic sensor is excited by a third externally applied ac magnetic field with a third set of at least two bypassing frequencies, the bypassing frequencies not being harmonics of one another, and the bypassing frequencies further not being harmonics of the first frequency.

2. A system, as in claim **1**, where the electronic circuit is enabled when the magnetic sensor is excited by a second externally applied ac magnetic field with second set of at least one second frequency, the second frequencies not being harmonics of one another.

3. A system, as in claim **1**, where the bypassed disabling function is re-enabled when the magnetic sensor is simultaneously excited by a second set of frequencies and the third set of frequencies.

4. A system, as in claim **1**, where the sensor is a coil with a core with a high permeability.

5. A system, as in claim **4**, where the permeability is at least 100 times greater than that of air.

6. A system, as in claim **4**, where the sensor is a coil and the core is an acousto-magnetic tag.

7. A system, as in claim **1**, where the sensor is a coil and the core is a piece of soft magnetic material with an adjacent hard magnet.

8. A system, as in claim **7**, where the soft magnetic material is a wire.

9. A system, as in claim **1**, where the sensor is a magnetic wire that exhibits the Matteucci effect.

10. A system, as in claim **1**, where the sensor is connected to the bandpass filter through a magnetic switch.

11. A method for disabling and enabling an external electronic circuit comprising the steps of:

inducing one or more first frequencies in a sensor;

filtering one or more of the first frequencies to create a first logic signal; setting a disable logic circuit with first logic signal to create a critical signal that disables the electronic circuit;

inducing, in the sensors two or more second frequencies that are not harmonically related to one another and are not harmonically related to the first frequency;

filtering one or more of each of the second frequencies to create one or more second filtered signals; and

setting the logic circuit with one or more of the second filtered signals to create a critical signal that enables the external electronic circuit.

12. A method for bypassing a disabling circuit capable of disabling an external electronic circuit, comprising the steps of:

inducing two or more bypass frequencies in a sensor, the bypass frequencies not harmonically related to one another;

filtering one or more of the bypass frequencies to create a bypass logic signal;

setting a logic circuit with one or more of the bypass logic signals to bypass a disabling logic;

simultaneously inducing, in the sensor, two or more second frequencies that are not harmonically related to one another and are not harmonically related to the bypass frequencies;

filtering one or more of each of the second frequencies to create one or more second filtered signals; and

setting the logic circuit with one or more of the second filtered signals so that the logic circuit does not by-pass the disabling logic.

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